

REGULATED GAS SUPPLY SYSTEM

FIELD OF THE INVENTION

[0001] The present application claims priority to United States Provisional Patent Application No. 60/402,464, filed on August 9, 2002.

DESCRIPTION OF PRIOR ART

[0002] Because small pneumatically operated devices require a supply of pressurized gas at constant pressure, current technology requires the use of external tanks or compressors in conjunction with a separate gas pressure regulator. In order to supply the regulated gas to the device, either a hose is required from the regulated supply to the inlet port of the device, or the tank and regulator must be externally attached to the device. This requirement limits both usability and portability.

[0003] For devices that only require a small volume of gas, a miniature, self-contained, regulated gas supply is desired. Current high-pressure regulators are large and bulky, and require a means of attaching them to a high-pressure gas reservoir. Further, current reservoirs themselves are too large to be practical for use with portable and small pneumatically operated systems.

BRIEF SUMMARY OF THE INVENTION

[0004] The present invention is a regulated gas supply containing both a pressurized gas reservoir and a high-pressure regulator. The system is miniature and self-contained to fit inside any number of small pneumatically operated devices. Furthermore, the regulated gas supply can be designed to facilitate rapid replacement of the entire assembly in order to replenish the gas supply once the reservoir is depleted, and the gas reservoir is easily replenish with gas after being emptied.

[0005] The combination of all of the above features has not been previously accomplished in a portable regulated gas supply.

BRIEF DESCRIPTION OF THE DRAWING

[0006] An apparatus embodying features of the claimed invention are depicted in the accompanying drawing which form a portion of this disclosure and wherein:

[0007] Figure 1 is a sectional view of the regulated gas supply system comprising a high-pressure reservoir and a balanced regulator assembly including a piston and piston chamber;

[0008] Figure 2 is a sectional view of the regulated gas supply system as illustrated in Figure 1, with the piston being forced proximate the chamber seat; and

[0009] Figure 3 is a sectional view of the regulated gas supply system of the present invention used in a firearm simulator.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] Referring to Figure 1, the regulated gas supply **100** of the present invention is illustrated. The regulated gas supply **100** is a miniature and self-contained apparatus. In particular, the regulated gas supply **100** includes a body **1** or cartridge containing a pressurized reservoir **4** and a regulating assembly **20**. The regulating assembly **20** includes a piston **3** having a piston flange **3a** and a spring **5** that are housed in a piston chamber **6**. The piston chamber **6** includes a chamber seat **6a** and an uppermost surface **6b** opposite said chamber seat **6a**, with a chamber wall **6c** connecting said chamber seat **6a** and uppermost surface **6b**. The spring **5** is positioned between the piston flange **3a** and the chamber seat **6a**. The force of the spring **5** will tend to push the piston **3** away from the chamber seat **6a**, thereby allowing gas to flow from inlet passage **8** to piston channel **10**, and then out of the body through gas outlet **2**.

[0011] Comparing Figures 1 and 2, as the pressure in the gas outlet **2** increases, pressure will also increase in upper cavity **11** of the piston chamber **6**. As the pressure in upper cavity **11** increases, a force develops on the piston **3** proportional to the pressure in upper cavity **11**. This pressure in the upper cavity **11** counteracts the force of the spring **5**, and when the pressure is great enough, the piston **3** will be forced against the seat **6a** (see Figure 2). When the piston **3** abuts the chamber seat **6a**, piston channel **10** within the piston **3** will

abut the body 1, thereby preventing further gas flow from the gas reservoir 4. Furthermore, the piston chamber 6 containing the spring 5 is vented to the atmosphere through vent aperture 7, thus maintaining a constant relationship between regulated pressure and atmospheric pressure.

[0012] In order to counteract the force of the high pressure against the portion of the piston 3 that is constantly exposed to the high pressure in the gas reservoir 4, the present design further includes a secondary chamber 9 that is engaged by one end of the piston 3. In particular, the piston 3 includes a piston body 3b and a piston extension 3c, wherein piston extension 3c engages the secondary chamber 9. A central channel 12 is employed through the piston body 3b and piston extension 3c to allow the high-pressure gas to flow into the secondary chamber 9. The area of the piston 3 acted upon by the gas in secondary chamber 9 is equal to the area of the piston 3 that is constantly exposed to the same high-pressure gas. This arrangement causes the piston 3 to be balanced, so that changes in the pressure of the gas in the reservoir 4, such as when gas is withdrawn during use, or due to temperature changes in the gas, do not affect the regulated pressure at the outlet port 2. The pressure at the outlet 2 is therefore proportional to the force of the spring 5. If the force of spring 5 is increased, the regulated pressure is also increased, conversely, if the force of the spring 5 is decreased, the regulated pressure is also decreased.

[0013] It is foreseen that the present self-contained regulated gas supply 100 can be used in multiple designs of pneumatically operated devices that require a portable supply of pressurized gas at constant pressure for convenient operation of the particular device. In one embodiment, the regulated gas supply 100 could be used with firearm simulators 30, such as the one illustrated in Figure 3. In this embodiment, the regulated gas supply 100 is able to provide the necessary gas at the desired pressure level such that the release of the gas at gas outlet 2 will control the simulated force of the firearm 30 being shot, and it may further provide the necessary force to lock the firearm from further operation.

[0014] Thus, although there have been described particular embodiments of the present invention of a new and useful REGULATED GAS SUPPLY SYSTEM, it is not intended that such references be construed as limitations upon the scope of this invention except as set forth in the following claims.